

Notice of Allowability

Application No.

10/707,729

Examiner

Jerry Martin Blevins

Applicant(s)

HALLEMEIER ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to interview conducted June 27, 2007.
2. ☒ The allowed claim(s) is/are 1-44.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date 20070627.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Kurt Rauschenbach on June 27, 2007.

The application has been amended as follows:

In claim 1, line 7, after the phrase "including a fundamental mode with information content" and before the phrase "and conditioning a modal profile", insert --, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal,--.

In claim 28, line 5, after the phrase "including a fundamental mode with information content" and before the phrase "and conditioning a modal profile", insert --, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal,--.

Allowable Subject Matter

Claims 1-44 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the prior art, as best exemplified by US 6,360,045 to Shoval et al., teaches a multi-mode optical fiber link (Figure 13) comprising:

- (a) a single-mode optical fiber (element 104) having an input that receives an optical signal for transmission through the multi-mode optical fiber link;
- (b) a first spatial mode converter (126) having an input that is coupled to an output of the single-mode optical fiber, the first spatial mode converter converting the optical signal to a plurality of modes and conditioning a modal profile of the optical signal for propagation through a multi-mode optical fiber (column 9, line 20 – column 10, line 4);
- (c) a multi-mode optical fiber (128) having an input that is coupled to an output of the first spatial mode converter, the multi-mode optical fiber propagating the optical signal having the plurality of modes; and
- (d) a second spatial mode converter (130) having an input that is coupled to an output of the multi-mode optical fiber, the second spatial mode converter reducing a number of optical modes in the optical signal.

However, Shoval, alone or in combination with the prior art, fails to disclose or render obvious that the first spatial mode converter converts the optical signal to a plurality of modes including a fundamental mode with information content, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal.

On the contrary, Shoal teaches converting to a plurality of modes including substantially a single higher-order mode and noise, which contains no information content, generated in the fundamental mode. Furthermore, Shoal is silent with respect to reduction of modal dispersion and increasing bandwidth of the signal.

Claims 2-19 are allowed due to dependence from allowed base claim 1.

Regarding claim 20, the prior art, as best exemplified by Shoal, teaches a method of increasing an effective modal bandwidth of an optical signal transmitting through a multi-mode optical fiber (column 9, line 20 – column 10, line 4), the method comprising:

(a) spatial mode converting (using special mode converter 126, Figure 13) an optical signal to a plurality of modes (column 2, line 66 – column 3, line 15, column 8, lines 49-64 and column 9, line 20 – column 11, line 50),

(b) launching the spatially mode converted optical signal having the plurality of modes into a multi-mode optical fiber (128);

(c) propagating the spatially mode converted optical signal having the plurality of modes through the multi-mode optical fiber (128); and

(d) spatial mode converting (using spatial mode converter 130) the spatially mode converted optical signal propagating through the multi-mode optical, thereby further reducing modal dispersion and further increasing the effective bandwidth of the optical signal (column 9, line 20 – column 10, line 4).

However, Shoal, alone or in combination with the prior art, fails to disclose or render obvious that the first spatial mode converting converts the optical signal to a

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plurality of modes including a fundamental mode with information content, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal.

On the contrary, Shoval teaches converting to a plurality of modes including substantially a single higher-order mode and noise, which contains no information content, generated in the fundamental mode. Furthermore, Shoval is silent with respect to reduction of modal dispersion and increasing bandwidth of the signal.

Claims 21-27 are allowed due to their dependence from allowed base claim 20.

Regarding claim 28, the prior art, as best exemplified by Shoval, teaches a multi-mode optical communication system (Figure 13) comprising:

- (a) an optical transmitter (102) that generates an optical signal at an output;
- (b) a first spatial mode converter (126) having an input that is coupled to an output of the single-mode optical fiber, the first spatial mode converter converting the optical signal to a plurality of modes (column 2, line 66 – column 3, line 15, column 8, lines 49-64 and column 9, line 20 – column 11, line 50) and conditioning a modal profile of the optical signal for propagation through a multi-mode optical fiber (column 9, line 20 – column 10, line 4);
- (c) a multi-mode optical fiber (128) having an input that is coupled to an output of the first spatial mode converter at an interface, the interface exciting higher-order modes in the optical signal propagating in the multi-mode optical fiber (column 9, line 20 – column 10, line 4);
- (d) a second spatial mode converter (130) having an input that is coupled to an output of the multi-mode optical fiber, the second spatial mode converter reducing a

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number of optical modes in the optical signal, wherein both the first and the second spatial mode converters increase an effective bandwidth of the optical signal propagating through an output of the second spatial mode converter (column 9, line 20 – column 10, line 4); and

(e) an optical receiver (114) having an input that is coupled to the output of the second spatial mode converter, the optical receiver receiving the optical signal.

However, Shoal, alone or in combination with the prior art, fails to disclose or render obvious that the first spatial mode converter converts the optical signal to a plurality of modes including a fundamental mode with information content, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal. On the contrary, Shoal teaches converting to a plurality of modes including substantially a single higher-order mode and noise, which contains no information content, generated in the fundamental mode. Furthermore, Shoal is silent with respect to reduction of modal dispersion and increasing bandwidth of the signal.

Claims 29-43 are allowed based on their dependence from allowed base claim 28.

Regarding claim 44, Shoal teaches a multi-mode optical communication system (Figure 13), comprising:

(a) a means for spatial mode converting (using special mode converter 126, Figure 13) an optical signal to a plurality of modes,

(b) a means for launching the spatially mode converted optical signal having the plurality of modes into a multi-mode optical fiber (128);

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(c) a means for propagating the spatially mode converted optical signal having the plurality of modes through the multi-mode optical fiber (128); and

(d) a means for spatial mode converting (using spatial mode converter 130) the spatially mode converted optical signal propagating through the multi-mode optical, thereby further reducing modal dispersion and further increasing the effective bandwidth of the optical signal (column 9, line 20 – column 10, line 4).

However, Shoval, alone or in combination with the prior art, fails to disclose or render obvious that the first means for spatial mode converting converts the optical signal to a plurality of modes including a fundamental mode with information content, thereby reducing modal dispersion and increasing an effective bandwidth of the optical signal. On the contrary, Shoval teaches converting to a plurality of modes including substantially a single higher-order mode and noise, which contains no information content, generated in the fundamental mode. Furthermore, Shoval is silent with respect to reduction of modal dispersion and increasing bandwidth of the signal.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jerry Martin Blevins whose telephone number is 571-272-8581. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on 571-272-2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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